OPERATION DOMINIC

APRIL - NOVEMBER 1962

RADIOLOGICAL SAFETY

ISSUED: 1 APRIL 1963

JOINT TASK FORCE EIGHT

FOR OFFICIAL USE ONLY

HEADQUARTERS
JOINT TASK FORCE EIGHT
WASHINGTON 25, D. C.

ADDRESS REPLY TO:
COMMANDER,
JOINT TASK FORCE EIGHT

1 APR 1963

JJC-R

SUBJECT: Operation DOMINIC Radiological Safety Report

TO: DISTRIBUTION

1. This report contains a detailed description of the radiological safety support functions during Operation DOMINIC and is forwarded for information and possible future use.

FOR THE COMMANDER

H. E. PARSONS
Colonel, USAF
Chief of Staff

DISTRIBUTION

DOD ACTIVITIES

3 CHDASA, ATTN. DOCUMENT LIBRARY, WASHDC

2 FCDASA, ATTN. FCTG, SANDIA BASE, NEW MEXICO

1 CJTG 8.3, ATTN.RADSAFE OFFICER

1 CJTG 8.4, ATTN.RADSAFE OFFICER

1 CJTG 8.5, ATTN.RADSAFE OFFICER

USA ACTIVITIES

1 DIRECTOR FOR CBR OPERATIONS, DCSOPS, DEPT OF THE ARMY, WASHDC

3 COMMANDER, NUCLEAR DEFENSE LABORATORY, EDGEWOOD ARSENAL, MD.

1 USA CHEMICAL CORPS TRAINING COMMAND, FT. MCCLELLAN, ALA.

1 USA CBR ORIENTATION COURSE, DUGWAY PROVING GROUND, UTAH

1 NUCLEAR WEAPONS SYSTEM SAFETY GROUP, ENGINEER PROVING GROUND, FT. BELVOIR, VA.

USN ACTIVITIES

1 USN RADIOLOGICAL LAB. ATTN. MR. E.J. LEAHY, SAN FRANCISCO, CALIF.

1 USN RADIOLOGICAL LAB. ATTN. MR. R.K. FULLER, SAN FRANCISCO, CALIF.

1 NUCLEAR WEAPONS TRAINING CENTER, ATLANTIC, NORFOLK 11, VA.

1 NUCLEAR WEAPONS TRAINING CENTER, PACIFIC, USNAS, SAN DIEGO 25, CALIF.

1 USN DAMAGE CONTROL TRAINING CENTER, PHILADELPHIA, PA.

USAF ACTIVITIES

1 USAF SYSTEMS COMMAND, ANDREWS AFB, MD.

1 USAF BALLISTIC SYSTEM DIV., NORTON AFB, CALIF.

1 USAF, PACIFIC,HICKAM AFB, HAWAII.

1 USAF SPECIAL WEAPONS CENTER, ATTN. DIRECTORATE OF NUCLEAR SAFETY (AFINS-D), KIRTLAND AFB, NEW MEXICO

1 USAF STRATEGIC AIR COMMAND, OFFUTT AFB, NEBRASKA

USAEC ACTIVITIES

3 USAEC DIV. OF OPERATIONAL SAFETY, GERMANTOWN, MD.

1 USAEC, NEVADA OPERATIONS OFFICE, LAS VEGAS, NEVADA

2 REYNOLDS ELECTRICAL AND ENGINEERING CO. INC., HEALTH, MEDICINE AND SAFETY DEPT. ATTN. RADSAFE DIV., MERCURY, NEVADA

1 LOS ALAMOS SCIENTIFIC LAB., ATTN. MR. LEO CHELIUS, LOS ALAMOS, NEW MEXICO

1 LAWRENCE RADIATION LAB., ATTN. MR. JASON MINKLER, LIVERMORE, CALIF.

1 OAK RIDGE OFFICE OF TECHNICAL INFORMATION, BOX 62, OAK RIDGE, TENN.

1 SANDIA CORP., ATTN. TECHNICAL LIBRARY, P.O. BOX 5800, SANDIA BASE, NEW MEXICO

OTHER ACTIVITIES

3 USPHS, DIV. OF RADIOLOGICAL HEALTH, WASHDC

1 USPHS, LAS VEGAS, NEVADA

1 RADIATION EFFECTS INFORMATION CENTER, BATTELLE MEMORIAL INSTITUTE COLUMBUS 1, OHIO

1 COMMANDER, ARMED SERVICES TECHNICAL INFORMATION AGENCY, ATTN. TIPCR, ARLINGTON HALL STATION, ARLINGTON 12, VA.

406770

ABSTRACT

THIS DOCUMENT IS A REPORT FROM THE CHIEF, RADSAFE BRANCH TO THE COMMANDER, JOINT TASK FORCE EIGHT COVERING RADIOLOGICAL SAFETY SUPPORT DURING OPERATION DOMINIC. IT CONTAINS A DESCRIPTION OF THE MISSION, ORGANIZATION, AND ACTIVITIES OF THE RADSAFE BRANCH AND TEMPORARY SUPPORT ELEMENTS, JOINT TASK FORCE EIGHT, DURING THE 1962 NUCLEAR TEST SERIES CONDUCTED IN THE PACIFIC OCEAN AREA. RADSAFE BRANCH, A PART OF THE J-3 DIVISION, WAS CHARGED WITH THE RESPONSIBILITY OF PROVIDING RADIOLOGICAL SAFETY SUPPORT FOR THE TASK FORCE. THE VARIOUS CHAPTERS ARE DEVOTED TO A DISCUSSION OF THE ACTIVITIES ENGAGED IN BY RADSAFE BRANCH, AND THE ORGANIZATION NECESSARY TO PROVIDE RADIOLOGICAL SAFETY SUPPORT FOR A WEAPONS TEST OPERATION OF THE MAGNITUDE OF OPERATION DOMINIC. IN CONTRAST TO PREVIOUS OPERATIONS, NO FALLOUT OF SIGNIFICANCE OCCURRED AS A RESULT OF THE AIR DROPS. SPECIAL PROBLEMS ARISING FROM THE HIGH ALTITUDE EVENTS ARE DISCUSSED.

ACKNOWLEDGEMENTS

Radsafe Branch wishes to acknowledge the cooperation and support of the following organizations. Their combined efforts were largely responsible for the success of the radiological safety operations during Operation DOMINIC:

U.S. Public Health Service, Washington, D.C.

Office of the Chief Chemical Officer, Washington, D.C.

U.S. Army Chemical Corps Radiological Unit
Dugway Proving Ground, Utah

U.S. Army Chemical Corps Training Command
Fort McClellan, Alabama

U.S. Army Chemical Corps Nuclear Defense Laboratory
Army Chemical Center, Maryland

Division of Operational Safety, AEC
Germantown, Maryland

In addition, the following individuals are to be credited with making significant contribution that materially assisted Radsafe Branch during all phases of Operation DOMINIC:

Dr. Thomas L. Shipman,	Los Alamos Scientific Laboratory
Mr. Leo Chelius,	Los Alamos Scientific Laboratory
Mr. George Littlejohn,	Los Alamos Scientific Laboratory
Mr. William Tammany,	Los Alamos Scientific Laboratory
Mr. Jayson Minkler,	Lawrence Radiation Laboratory
Mr. Howard Eberline,	Eberline Instrument Corporation
Mr. Floyd W. Wilcox,	Reynolds Electrical and Engineering Co.

CONTENTS PAGE

Abstract 1

Acknowledgement 2

Chapter 1 6

ORGANIZATION

1.1 Radsafe Branch Mission 6
1.2 Radsafe Branch Organization 6
1.3 Procurement of Personnel 7
1.4 Training of Personnel 8
1.5 Radsafe Support Functions 8

Chapter 2 9

CHRISTMAS ISLAND OPERATIONS

2.1 Facilities and Services 9
2.2 On-Site Radsafe Activities 9

2.2.1 Pre-operational Survey to Obtain Baseline Data 9
2.2.2 Establishment of Static Sites for Routine Documentation 9
2.2.3 Mobile Monitoring on Shot Days 9
2.2.4 Cloud Tracking Information 11
2.2.5 Decontamination 11
2.2.6 Post-operational Survey 11

2.3 Shots and Survey Results 12

Chapter 3 14

OFF-SITE OPERATIONS

3.1 Facilities and Services 14

3.1.1 Primary Stations 14
3.1.2 Secondary Stations 14
3.1.3 Background Stations 14
3.1.4 Laboratory Facilities in Honolulu 16

3.2 Results 16a

Chapter 4 17

JOHNSTON ISLAND OPERATIONS

4.1 Facilities and Services 17

4.1.1 Routine Radiological Safety 17
4.1.2 Disaster Control 17

4.2 Unusual Incidents During Johnston Island Phase I 18

4.2.1 STARFISH 18
4.2.2 BLUEGILL PRIME 18

4.3 Johnston Island Phase II 23

4.3.1 Atmospheric Events 23
4.3.2 High Altitude Events 24

4.4 Shots and Survey Results 24

Chapter 5

PERSONNEL DOSIMETRY 26

5.1 Film Badge Processing and Record Posting 26

5.2 Film Badges 28

5.3 Pocket Dosimeters 28

Chapter 6

SUPPLY 29

6.1 Procurement of Equipment 29

6.2 Instrument Maintenance 29

FIGURES:

Fig. 2.1 Christmas Island, Showing Main Road Network and Site Locations 10
Fig. 3.1 Pacific Ocean Area, Showing Radsafe Stations and Boundaries of Danger Area 15
Fig. 4.1 Johnston Island, Showing THOR Launch Pad Nr. 1, Decontamination Facilities and Several Key Facilities 19

Fig. 4.2 Initial Radiological Survey of THOR Launch Pad Nr. 1 on Morning Following BLUEGILL PRIME Abort 20

TABLES:

Table 2.1 Christmas Island Events During Operation DOMINIC 13
Table 4.1 Johnston Island Events During Operation DOMINIC 25
Table 6.1 Radsafe Equipment and Supplies 30

CHARTS:

Chart 1.1 Functional Radsafe Elements Assigned For Support at Certain Locations 8a
Chart 1.2 Support Performed by Radsafe Elements at Certain Locations 8b

Chapter 1

ORGANIZATION

1.1 Radsafe Branch Mission

The mission of the Radsafe Branch was to:

1. Maintain a current plot of all contaminated areas.

2. Provide necessary equipment, such as disposable clothing and radsafe survey instruments, for support of operations associated with contaminated areas or facilities.

3. Provide dosimetry services for all Joint Task Force EIGHT (hereinafter also referred to as Task Force or JTF 8) personnel and authorized visitors to include the issuance and processing of film badges and the maintenance of required exposure records.

4. Advise and assist Task Force personnel as required in the decontamination (decon) of equipment.

5. Operate a radiochemistry laboratory capable of supporting off-site radsafe monitoring stations and any other radsafe operations.

6. Provide trained personnel, as available, to assist CJTG 8.3 and CJTG 8.4 in the accomplishment of their assigned radsafe responsibilities.

1.2 Radsafe Branch Organization

The Joint Table of Distribution for Headquarters, Joint Task Force EIGHT provided for a Radiological Safety Branch consisting of the following personnel:

	CODE	GRADE	SERVICE
Chief	7330	05	Army
Radsafe Off	2075	04	Navy
Radsafe Off	1955	03	Air Force
Admin Clerk	2511	E5	Navy
Clerk Typist	7110	E4	Army

In actual practice the Radsafe Branch consisted of the following personnel:

Chief	7330	05	Army
Radsafe Off	7330	04	Army
Radsafe Off	None	03	USPHS
Admin Clerk	0000	E5	Navy

In contrast to previous operations, there was no separate task unit organization for Radsafe. Radsafe operations were managed both at the Task Force as well as Task Group level. TU 8.5.1 (H&N) radsafe personnel were utilized within the JTG 8.5 (USAEC) organization in situations affecting JTG 8.5 personnel.

1.3 Procurement of Personnel

Personnel required to accomplish the radsafe mission were obtained from all services; Army, Navy, and Air Force. Most of these were obtained from the Chemical Corps Radiological Unit (CCRU; formerly designated as the First RSSU) and assigned to the Task Force in a temporary duty status. Joint Task Group 8.4, which supplied a large number of its own radsafe personnel, received most of the CCRU personnel since a significant portion of the radsafe operation involved decontamination of aircraft and crews.

JTG 8.4 also controlled the Instrument Repair Section for maintaining radsafe instruments. Other CCRU personnel were assigned to the Radsafe Branch for direction of ground surveys associated with post-shot monitoring for potential fallout contamination. The following is a source breakdown of the total personnel obtained for support by the Chief, Radsafe Branch:

Chemical Corps Radiological Unit Dugway Proving Ground, Utah	2 Off & 20 EM
Chemical Corps Training Command Fort McClellan, Alabama	8 EM
U.S. Army Chemical Corps Nuclear Defense Laboratory, Army Chemical Center, Maryland	3 EM
DASA Field Command Sandia Base, New Mexico	1 EM
U.S. Naval School Command Treasure Island, California	3 Off & 1 EM
U.S. Naval Damage Control Training Center Philadelphia, Pennsylvania	1 Off
USNRDL, San Francisco, California	1 Civ.
Los Alamos Scientific Laboratory Los Alamos, New Mexico	1 Civ. Health Physicist 1 Civ. Laboratory Technician 1 Civ. Radsafe Specialist

These 43 personnel were apportioned to the radsafe program as follows:

Radsafe Branch	1 Off - 6 EM - 3 Civ
JTG 8.3	4 Off - 1 EM - 1 Civ
JTG 8.4	1 Off -23 EM
USPHS (Honolulu)	3 EM

It is pointed out, with respect to the Radsafe Branch, that two of the civilians and five of the enlisted men were occupied mainly with film badge dosimetry work. Radsafe Branch was assisted in ground monitoring surveys by USPHS, TU 8.5.1 and JTG 8.5. CJTG 8.3 and CJTG 8.4 supplied their own radsafe

personnel, as required, to meet task group requirements. Task Unit Laboratories were assisted by Radsafe Branch.

1.4 Training of Personnel

No training was necessary for the personnel procured by Chief, Radsafe Branch, due to the experience gained by these personnel during previous testing operations. JTG 8.3 and JTG 8.4 each conducted its own separate one week training program for task group radsafe personnel. Project personnel in scientific task units and contractor personnel in JTG 8.5 provided their own monitors for recovery and construction missions respectively.

1.5 Radsafe Support Functions

Chart 1.1 depicts the functional organization for execution of the radsafe mission on-site and support of radsafe off-site activities. It illustrates the working structure for certain functions of support required at various geographical locations. As stated previously, personnel were assigned to JTG 8.4 operational control as needed for decon and sample return assistance, and to JTG 8.3 operational control as required for pod recovery and handling operations. The off-site surveillance functions were performed by USPHS officers and are described separately in this report.

Chart 1.2 lists the specific tasks performed at various locations by the radsafe elements shown in Chart 1.1, and indicates the period of time during which the assistance was provided. The numbers of personnel assigned to these tasks varied throughout the operation as the degree of required assistance changed for specific events.

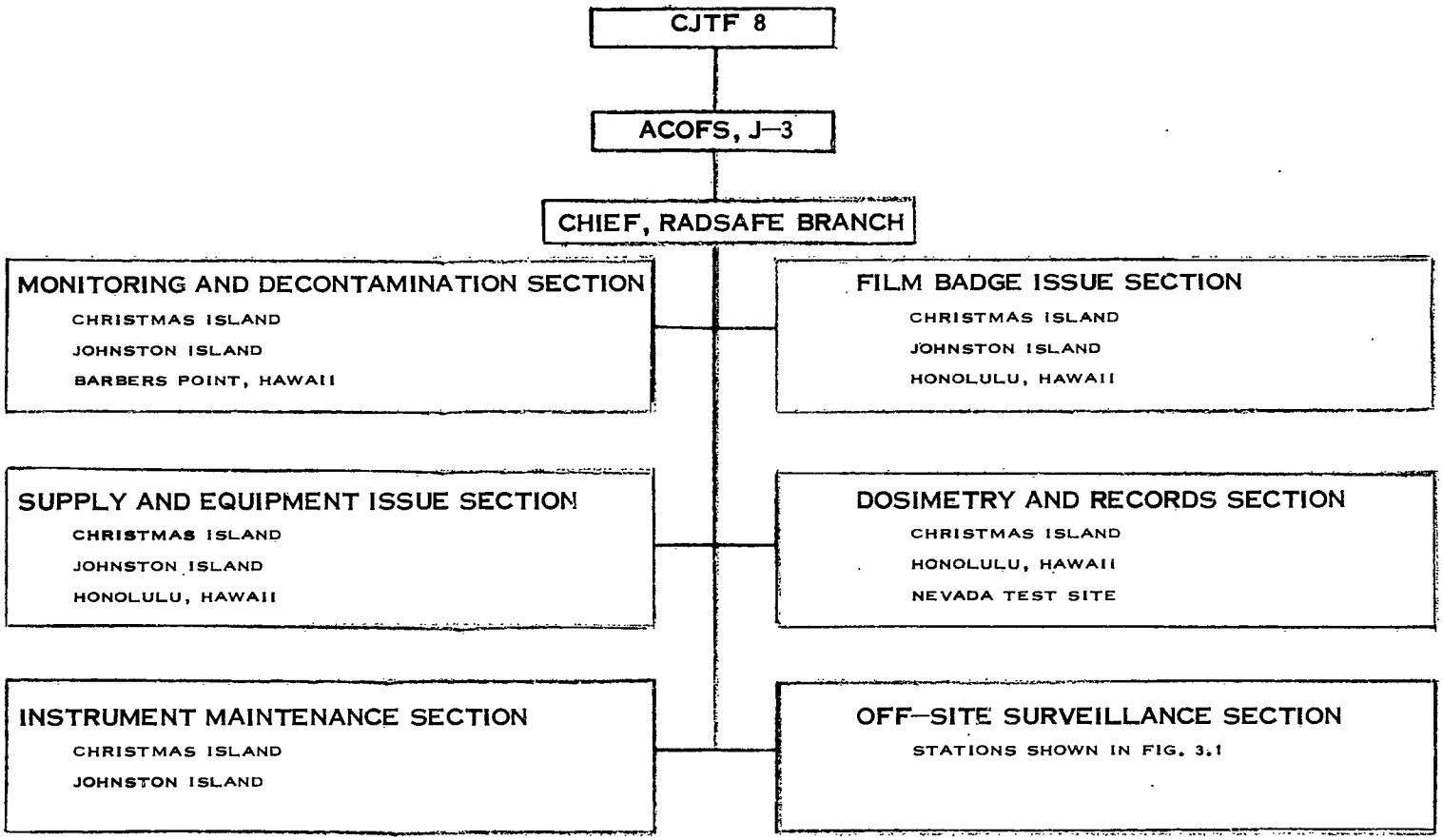

CHART 1.1 FUNCTIONAL RADSAFE ELEMENTS ASSIGNED FOR SUPPORT AT CERTAIN LOCATIONS

CHART 1.2 SUPPORT PERFORMED BY RADSAFE ELEMENTS AT CERTAIN LOCATIONS

CHRISTMAS ISLAND (25 APR 62–11 JUL 62)

- AREA MONITORING
- AIRCRAFT DECONTAMINATION
- PERSONNEL AND EQUIPMENT DECONTAMINATION
- FILM BADGE ISSUE AND COLLECTION
- PHOTODOSIMETRY
- PROTECTIVE CLOTHING AND EQUIPMENT ISSUE
- INSTRUMENT MAINTENANCE
- SAMPLE RETURN

JOHNSTON ISLAND (3 JUN 62–3 NOV 62)

- AREA MONITORING AND DECONTAMINATION
- AIRCRAFT DECONTAMINATION
- PERSONNEL AND EQUIPMENT DECONTAMINATION
- FILM BADGE ISSUE AND COLLECTION
- PROTECTIVE CLOTHING AND EQUIPMENT ISSUE
- INSTRUMENT MAINTENANCE
- SAMPLE RETURN
- SCIENTIFIC--POD RECOVERY

OFF–SITE (15 MAR 62–15 DEC 62)

- ENVIRONMENTAL MONITORING
- SAMPLE COLLECTION

HONOLULU, HAWAII (15 MAR 62–15 DEC 62)

- PHOTODOSIMETRY
- PROTECTIVE CLOTHING AND EQUIPMENT ISSUE
- RADIO-CHEMICAL ANALYSIS

NEVADA TEST SITE (15 DEC 62–30 JAN 63)

- PHOTODOSIMETRY

BARBERS POINT, HAWAII (2 OCT 62–3 NOV 62)

- AIRCRAFT DECONTAMINATION
- PERSONNEL AND EQUIPMENT DECONTAMINATION

Chapter 2

CHRISTMAS ISLAND OPERATIONS

2.1 Facilities and Services

The Radiological Safety Program for Operation DOMINIC was divided into two parts, on-site and off-site. The radsafe program was planned and administered by the Radsafe Branch, Headquarters, Joint Task Force EIGHT. Generally, the program assigned the responsibility for basic radiological safety to the individual task groups, and the Commanders, Joint Task Group 8.3 and Joint Task Group 8.4 were directed to establish their own radsafe working organization. These task group radsafe units were designed to cope with routine radsafe matters and the problems unique to the function for the task group itself, such as decontamination of sampler aircraft by JTG 8.4 and ship decontamination by JTG 8.3. Special functions delegated to task groups are contained in Annex J to CJTF 8 Operation Order 2-62. The nucleus of radsafe personnel came from the Hq of Joint Task Force EIGHT and support was provided from the U.S. Public Health Service (USPHS); and Holmes and Narver, Inc. (H&N), Los Alamos Scientific Laboratory (LASL) and the Field Command, DASA (FCDASA) for TU 8.5.1, TU 8.1.1 and TU 8.1.3 respectively.

2.2 On-Site Radsafe Activities

Specifically, this program was designed to control from a radsafe standpoint all individuals who entered the designated "exclusion" area. The major problem in this function was the control of personnel engaged in area monitoring at Christmas Island. Other special functions included the photodosimetry program for the entire Task Force and assistance to task groups during the on-site phase of the operation. The Christmas Island On-Site Radiological Monitoring Program was designed to provide continuous coverage by means of the actions described below:

2.2.1 Pre-Operational Survey to Obtain Baseline Data

This included collection of land and sea biota for laboratory analysis; environmental samplings of food, vegetation, water and soil, air, and marine specimens; radiation background readings along major road networks; and film badge stake lines to record the total integrated dosage throughout the period of the test series.

2.2.2 Establishment of Static Sites for Routine Documentation

This included stations located at London Port, "A" Site, and JTF 8 Joint Operations Center (JOC) to cover the populated area (see Fig. 2.1). Each station was provided with an Eberline RM-5 Continuous Background Gamma Recorder, a Gamma Survey Instrument (AN/PDR-27J), a rain collector, and a Staplex Hi-Vol Air Sampler (running continuously).

2.2.3 Mobile Monitoring on Shot Days

All nuclear events at Christmas Island were detonations of devices

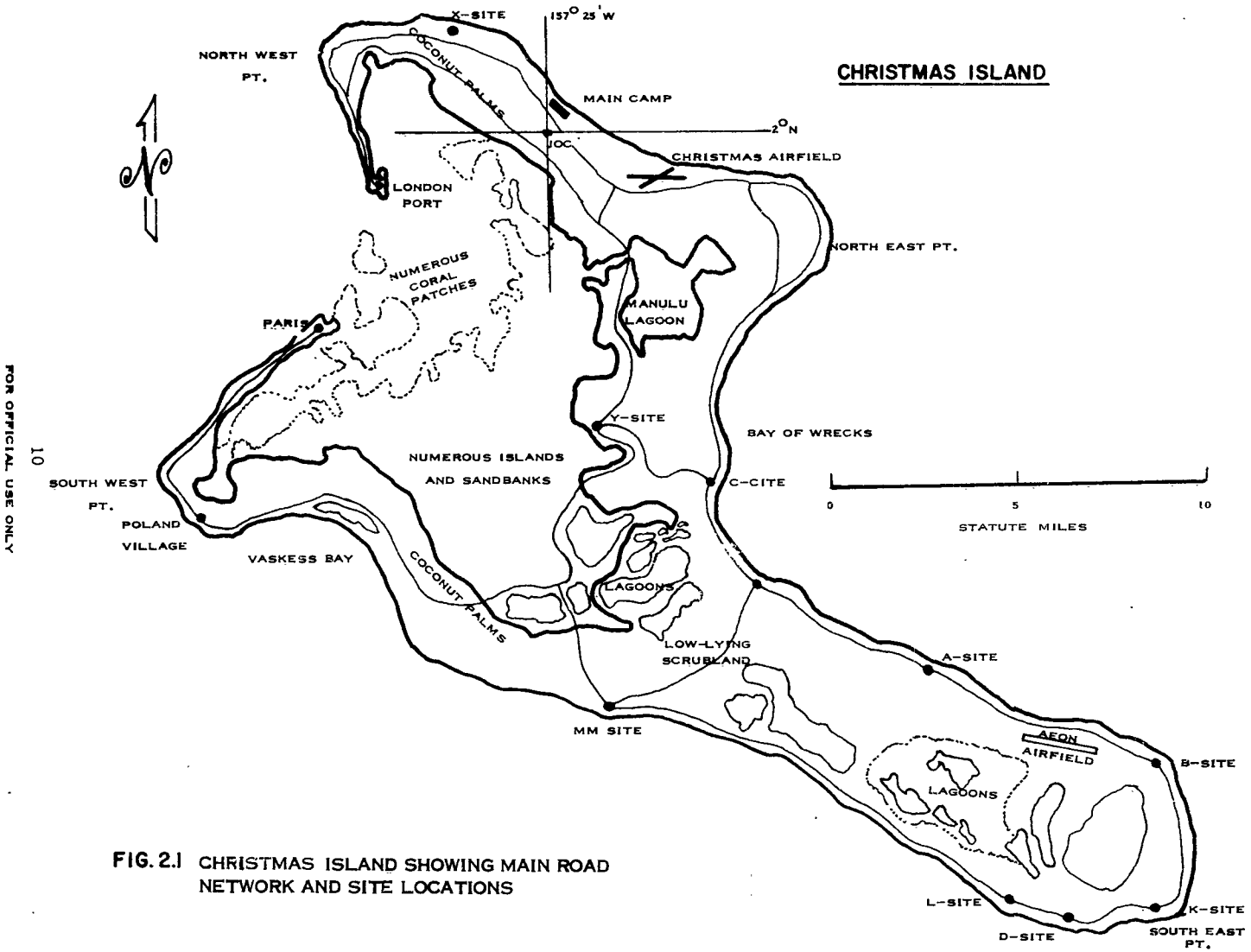

FIG. 2.1 CHRISTMAS ISLAND SHOWING MAIN ROAD NETWORK AND SITE LOCATIONS

released from a drop-aircraft. These detonations occurred as air bursts over designated target-rafts positioned in open water. Each detonation was planned for execution under favorable atmospheric conditions to minimize the likelihood of contamination (fallout) of land surfaces. Moreover, each event was followed by a post-shot radiological survey of the island to assure that no fallout had been received and to insure timely warning of the arrival of fallout in case of unforeseen wind shifts or rain squalls. This was accomplished by three two-man teams covering preplanned routes. Each team was equipped with two AN/PDR-27J low range beta-gamma survey meters and two AN/PDR-39 (T1B) high range gamma survey meters. Two teams conducted ground surveys of all major roads between London Port, "Y" Site, and "D" Site. The third team conducted a helicopter sweep of the south and southwest coastal area between "D" Site, "MM" Site, and Paris. Team control was by radio net from the radsafe office at the JOC. Radiation background readings were tabulated until H plus 5 hours on a log sheet for permanent record.

2.2.4 Cloud Tracking Information

B-57 sampler aircraft, under JTG 8.4, made early penetrations of the radioactive cloud after each event. A member of the Radsafe Branch obtained timely information on cloud movement, cloud top and base altitudes from the Air Operations Center (AOC) Controller. This information was necessary for preparation of advisories which specified reopening of air lanes for passage of commercial aircraft through the announced danger area.

2.2.5 Decontamination

A decontamination facility was established in the vicinity of the main airstrip. Sampler aircraft returning from a cloud penetration mission were taxied onto a specially built hardstand for washdown. This hardstand was of sufficient size to accomodate two aircraft; however, in practice only one aircraft at a time was washed by the jet-sprays from a decon truck since only four to seven aircraft participated in a mission. The runoff water was channeled through a trough into a large plastic swimming pool which served as a holding tank for liquid waste. This water was then pumped into a tanker truck for transport to the outfall point for release into the ocean. Aircraft crews and decon personnel were showered and dressed in a nearby personnel decon building of conventional design. The decon facility was supported by an adjacent laundry building outfitted with 4 washing machines, 4 extractors, and 1 large dryer. The aircraft decon pad and personnel decon and laundry facilities were operated by JTF 8 radsafe personnel. Film badging of mission aircraft crews was performed by radsafe personnel assigned to JTG 8.4. (Film badge processing is described in Chapter 5).

2.2.6 Post-Operational Survey

All film badges on the stake line were collected, processed, and a record made of the total dosage at each point. Additional information was obtained by survey meter readings along the stake line.

2.3 Shots and Survey Results

Table 2.1 contains a list of the nuclear events which occurred near Christmas Island. Technical details pertaining to these may be found in the JTF 8 Final Report of Operation DOMINIC.

Readings obtained from stations equipped with continuous background radiation monitoring equipment, high and low range radiation detection and measuring equipment, and continuous air and water sampling equipment, showed a continuously normal background level. At no time were there instances of detectable increases above background level.

Table 2.1

CHRISTMAS ISLAND EVENTS DURING OPERATION DOMINIC

NAME OF EVENT	DATE	YIELD RANGE*	TYPE
ADOBE	25 Apr 62	Intermediate	Air Drop
AZTEC	27 Apr 62	Intermediate	Air Drop
ARKANSAS	2 May 62	Low Megaton	Air Drop
QUESTA	4 May 62	Intermediate	Air Drop
YUKON	8 May 62	Intermediate	Air Drop
MESILLA	9 May 62	Intermediate	Air Drop
MUSKEGON	11 May 62	Intermediate	Air Drop
ENCINO	12 May 62	Intermediate	Air Drop
SWANEE	14 May 62	Intermediate	Air Drop
CHETCO	19 May 62	Intermediate	Air Drop
TANANA	25 May 62	Low	Air Drop
NAMBE	27 May 62	Intermediate	Air Drop
ALMA	8 Jun 62	Intermediate	Air Drop
TRUCKEE	9 Jun 62	Intermediate	Air Drop
YESO	10 Jun 62	Low Megaton	Air Drop
HARLEM	12 Jun 62	Intermediate	Air Drop
RINCONADA	15 Jun 62	Intermediate	Air Drop
DULCE	17 Jun 62	Intermediate	Air Drop
PETIT	19 Jun 62	Low	Air Drop
OTOWI	22 Jun 62	Intermediate	Air Drop
BIGHORN	27 Jun 62	Megaton	Air Drop
BLUESTONE	30 Jun 62	Low Megaton	Air Drop
SUNSET	10 Jul 62	Intermediate	Air Drop
PAMLICO	11 Jul 62	Low Megaton	Air Drop

* Low yield is below 100 KT

Intermediate yield is 100-1000 KT

Low Megaton yield is 1-5 MT

Megaton yield is above 5 MT

Chapter 3

OFF-SITE OPERATIONS

3.1 Facilities and Services

Under the terms of the Memorandum of Understanding dated 5 February 1962, between the Commander, Joint Task Force EIGHT and the Surgeon General, U.S. Public Health Service (USPHS), a network of off-site monitoring stations was operated by the USPHS for JTF 8 to document the radiation exposure to significant populated groups in and outside the danger areas of Christmas and Johnston Islands. This network, shown on Figure 3.1 consisting of primary stations, secondary stations, and background stations, totaled 19 stations in all. The network was operated out of Christmas Island with the primary stations reporting daily and the secondary and background stations reporting weekly to the Radsafe Office at Christmas Island.

3.1.1 Primary Stations

Primary stations were established on Fanning Island (Line Islands), Washington Island (Line Islands), and Honolulu, Oahu (Hawaiian Islands) in addition to the ones on Christmas Island (Line Islands) as described in Chapter 2. These stations were manned by USPHS Officers with equipment and sampling techniques to document all forms of radiation exposure. On both Washington and Fanning Islands the assigned USPHS Radsafe Officer acted as Island Commander and Evacuation Officer. Two-way radio contact with the Radsafe Office at Christmas Island was maintained.

3.1.2 Secondary Stations

Secondary stations were operated on the islands of Canton (Phoenix Islands), Malden (Line Islands), Penrhyn/Tongareva (Tonga Islands), Palmyra (Line Islands), Midway, Johnston and French Frigate Shoals (Tern Islands). These stations (with the exception of Palmyra and Johnston Islands) were located just outside the danger area and were designed to document air concentration and the external radiation background. The USPHS group at Christmas Island made checks of precipitation and important food items where situations warranted such action. These stations were operated by Task Force Project Groups and Weather Groups.

3.1.3 Background Stations

Background stations were operated by Task Force Project Groups or Weather Groups for JTF 8 on Tutuila (Samoa Islands), Rarotonga (Cook Islands), Wake Island and Kwajalein Atoll. The background stations at Taiohae, Nuku Hiva (Marquesas Islands) and Papeete, Tahiti (Society Islands) were manned by French personnel. These stations were rather distant from the test area and were designed primarily for documenting the external radiation background as well as any changes therein.

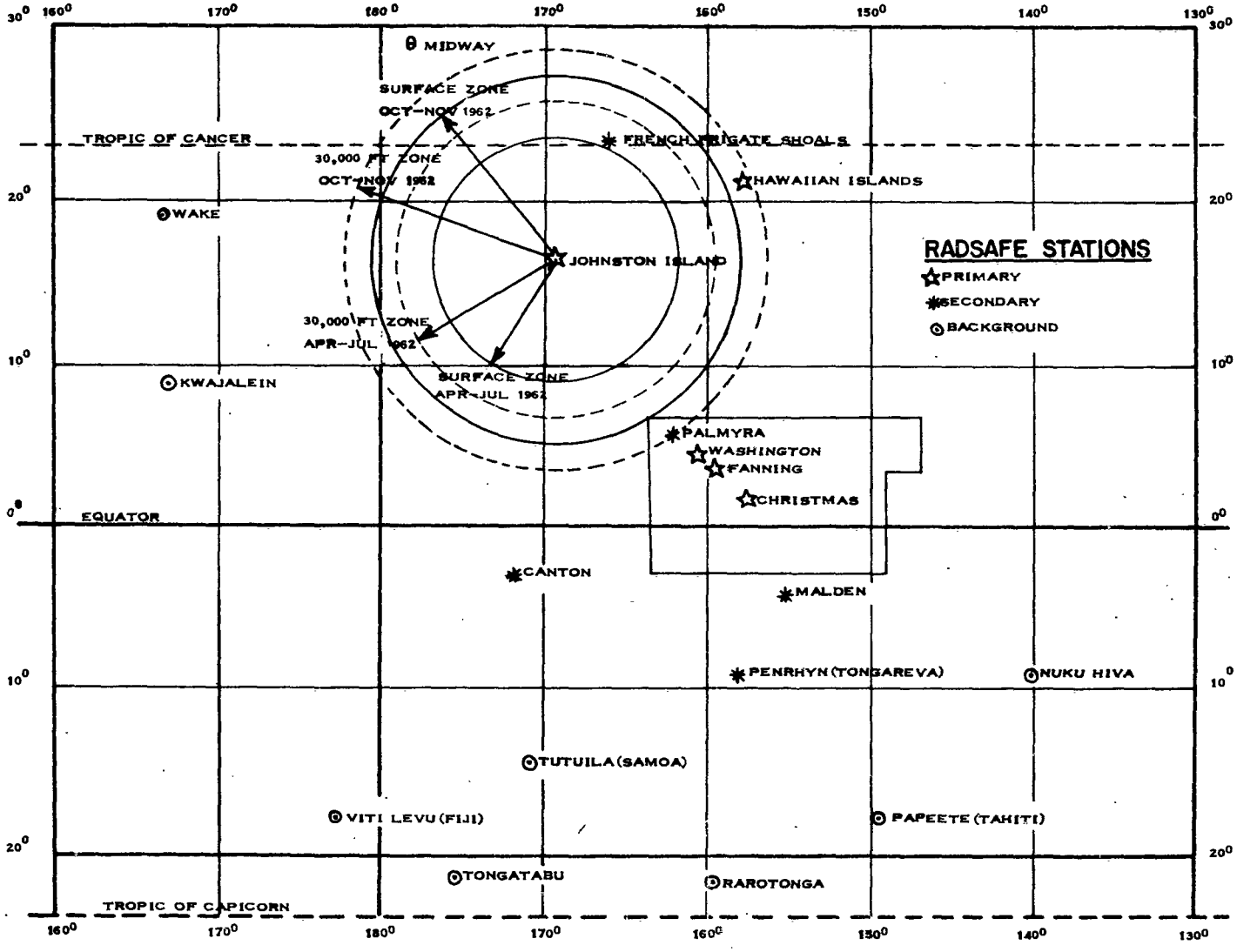

FIG. 3.1 PACIFIC OCEAN AREA SHOWING RADSAFE STATIONS AND BOUNDARIES OF DANGER AREAS

3.1.4 Laboratory Facilities in Honolulu

Additional support for radiological analysis of food, water, and air samples was provided by a complete laboratory facility in Honolulu, Hawaii. The laboratory was located in Hawaii to support both the Christmas Island and Johnston Island operations, and to insure a low radiation background installation, making possible complete and accurate radio-chemical analysis of environmental samples. An account of this laboratory's efforts is documented in the JTF 8 Operation DOMINIC report titled "Off-Site Radiological Safety" (see footnote) prepared by the Officer in Charge, JTF 8 Radiological Health Laboratory - Hawaii. Support facilities for film badge dosimetry were also installed in the laboratory, which was located in the Hawaii State Health Department Building. The Hawaii State Health Department made this space available under an agreement whereby JTF 8 would install all equipment and provide all utilities. The laboratory was under the direction of a USPHS officer. This laboratory was augmented by a radchem trailer which was on loan from the U.S. Army Chemical Corps Nuclear Defense Laboratory. In preparation for its use in off-site support, a suitable modification and rehabilitation was necessary prior to shipment from the parent laboratory. Costs incident to rehabilitation and shipment were met by JTF 8 radsafe funds.

This laboratory, which supported the JTF 8 Off-Site Surveillance Program of documenting radiation exposure to off-site populations during Operation DOMINIC, was established at Honolulu, Hawaii to provide a facility for the radio-chemical analysis of air, precipitation, water, milk, food, and soil. The USPHS, working with the Hawaii State Health Department, expanded the existing Hawaiian Surveillance Program so as to provide an extensive fallout monitoring program. As a consequence of these two programs, JTF 8 was provided with a strong capability of assessing radiation for public confidence. The results indicated that fallout encountered was minimal, with no significant exposure occurring to populated groups inside or outside the danger area.

A post-operational surveillance activity in the Pacific area was continued by JTF 8 under arrangement with USPHS whereby USPHS continued to retain, on a loan basis, JTF 8 owned laboratory equipment. The Radiological Health Laboratory-Hawaii was relocated to Damon Tract and continued to be maintained in a state of minimum operation in order to carry out this long-term (1 year) surveillance. The conviction to retain this laboratory was supported by three reasons: First, USPHS had performed analysis on pre-operational food samples collected from several inhabited islands surrounding the testing area. Consequently it appeared prudent that subsequent sampling should be performed for at least a year following termination of the test series, i.e., as new food crops came in. Secondly, dismantling of the laboratory and storage of the equipment would be costly and it was probable that any electronic equipment put into storage and not used would deteriorate seriously during the period of storage. Various pieces of equipment utilized by the

FOOTNOTE/ THIS REPORT, PREPARED BY USPHS FOR JTF 8, DESCRIBES THE OFF-SITE RADIOLOGICAL SAFETY PROGRAM AND CONTAINS TABULATION OF MONITORING DATA PREPARED BY THE RADIOLOGICAL HEALTH LABORATORY-HAWAII.

laboratory were owned by JTF 8, the AEC, and the USPHS. Thirdly, the maintenance of a laboratory capability at the proposed location would continue the congenial relationship with the Hawaii State Health Department. The building facility for the laboratory was provided by the USAEC.

3.2 Results

As far as can be determined from existing monitoring data and investigations of reported incidents, no hazardous fallout occurred to populated areas or to transient surface craft and aircraft as a result of Operation DOMINIC. A complete documentation of all radiation levels and interpretations is contained in the JTF 8 Operation DOMINIC report titled "Off-Site Radiological Safety" (see footnote on previous page)

Chapter 4

JOHNSTON ISLAND OPERATIONS

4.1 Facilities and Services

In contrast to the Christmas Island series, these events produced radiological situations, varying from recovery of lightly contaminated scientific pods to rehabilitation of a launch pad. Since certain aspects of these events occasioned an extension of the Johnston Island schedule, it is convenient to divide this portion into two phases for discussion. General aspects will be discussed in this section, followed by separate discussion of Phase I and Phase II in Sections 4.2 and 4.3 respectively. Phase I (25 Apr-25 Jul 1962) refers to that portion of the Operation DOMINIC test program which extends from commencement of the series up to and including the BLUEGILL PRIME event. The Christmas Island events were completed during Phase I. Phase II (2 Oct-3 Nov 1962) refers to the follow-on portion of the test program which resumed after the rehabilitation of THOR Launch Pad Nr. 1 which was damaged by fire during the BLUEGILL PRIME event. The Phase II portion included air drop events conducted at Johnston Island.

4.1.1 Routine Radiological Safety

The main effort of Radsafe was to provide personnel and equipment essential to the recovery of the scientific instrument pods which became contaminated as a result of the device detonation. Since three such pods required recovery, three fleet tugs (ATF), outfitted with crane and hoist, were situated in standby positions. The search and recovery procedure was planned as follows: A destroyer and three tugs would commence the search during darkness and would be joined by six helicopters during daylight. The helicopters, which flew in mutually protecting pairs, were actually the primary search and recovery means. If the helocopters located the pods, they would transport them to the land base. The tugs therefore were an alternate means of transport (if the pods were located in minimum time) to a location where transfer to an M-Boat could be accomplished. This specially configured M-Boat was designed with a shielding wall for crew protection. A JTF 8 radsafe specialist, equipped with RADIAC (radiation detection, indication, and computation) meters to assess the hazard prior to handling of the pods, was stationed on each fleet tug. The ultimate destination of the pods was a radsafe handling and holding area where detailed monitoring and decontamination could be performed. The handling area was provided with a field-type hot cell with slave manipulators for remote handling of items found to be more seriously contaminated. However, the hot cell facility was not used due to the fact that all pods recovered bore only low intensity contaminant.

4.1.2 Disaster Control

Each time a device (warhead) was moved in or out of Johnston Island, a radsafe representative was present at the airstrip to assist as required in the event of mishap involving damage or fire to the device. However, the major effort was concentrated in the manning and equipping

of the radsafe component of the Disaster Control Teams. During the launch of a missile carrying a nuclear warhead, Chief, Radsafe Branch stationed 2 officers, 1 instrument specialist, and 2 radsafe personnel from Task Unit 8.5.1 in the TU 8.1.3 bunker. Present at all times, both during shots and between shots, was a health physics expert from Task Unit 8.1.1 (LASL). This basic team was equipped with 8 AN/PDR-39 (T1B) gamma meters, 4 AN/PDR-39 (T1B) gamma meters modified for very high range, 4 GADORA gamma meters, 10 AN/PDR-27J low range beta-gamma meters, 1 MX-5 beta-gamma meter, and sufficient protective ensembles for all members of the disaster control teams including fire-fighting personnel. Although this was normally only a passive measure to provide the means of responding to a radiological disaster, the team was fully employed during two particular shots, the STARFISH and BLUEGILL PRIME events discussed in Section 4.2. During Phase II, the organization for disaster control was expanded. Disaster Control Teams, both ashore and afloat, were organized to provide for backup or relief contingency. The two teams were comparable in strength, proficiency and equipment, and each capable of independent response. The purpose of the additional offshore teams was to assure adequate reserve in case relief or replacement of the on-shore team were required.

4.2 Unusual Incidents During Johnston Island Phase I

4.2.1 STARFISH

The STARFISH warhead was destroyed in the air shortly after lift-off, causing several pieces of missile skin and miscellaneous debris to fall back onto Johnston Island and adjacent waters. A thorough search for debris was immediately initiated and a goodly collection of alpha contaminated scrap was isolated in an unused corner of the missile launch pad enclosure. No contamination to any portion of Johnston Island was detected as a consequence of debris impaction onto the island.

4.2.2 BLUEGILL PRIME

This event terminated in a destruct of the warhead on THOR Launch Pad No. 1 (see figure 4.1 and 4.2). During this event, the missile burned on the launch mount and the warhead was intentionally destroyed. This resulted in a deposition of alpha contamination on the launch pad complex, which presented a contamination problem of major proportions. Contaminated debris was scattered throughout the wire-enclosed pad area and neighboring areas. No contamination, other than pieces of removable debris, was found outside the concertina. Metal revetment buildings were highly contaminated with alpha activity. Burning fuel flowing through cable trenches caused contamination of the interior of the revetments and all equipment contained therein. Fuel which spilled and flowed over the compacted coral surrounding the launch mount and revetments resulted in highly contaminated areas. Prevailing winds at the time of destruction caused general contamination of all areas downwind of the launch mount. Figure 4.2 presents the results of the initial radiological survey on the morning following the deliberate destruct. The selected point readings around the still undisturbed area are a documentation of general

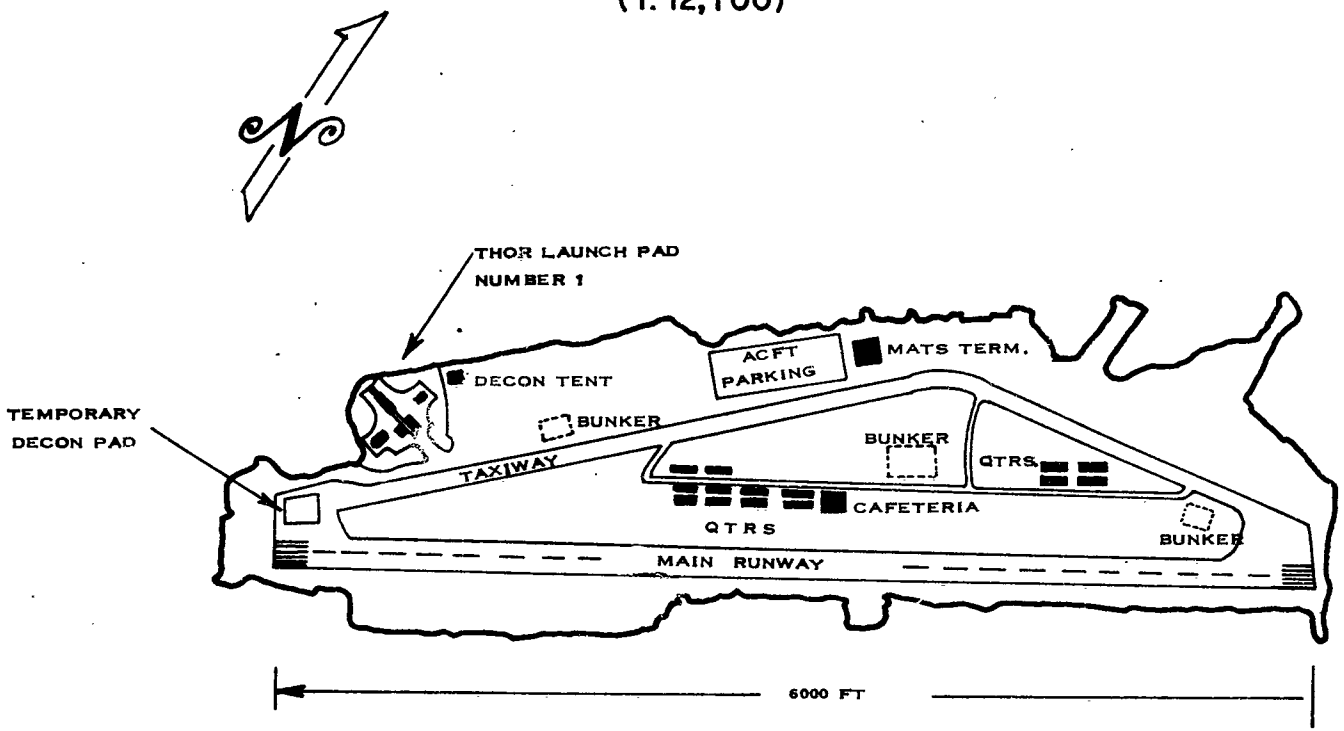

FIG. 4.1 . JOHNSTON ISLAND SHOWING THOR LAUNCH PAD NR. 1, DECONTAMINATION FACILITIES AND SEVERAL KEY FACILITIES.

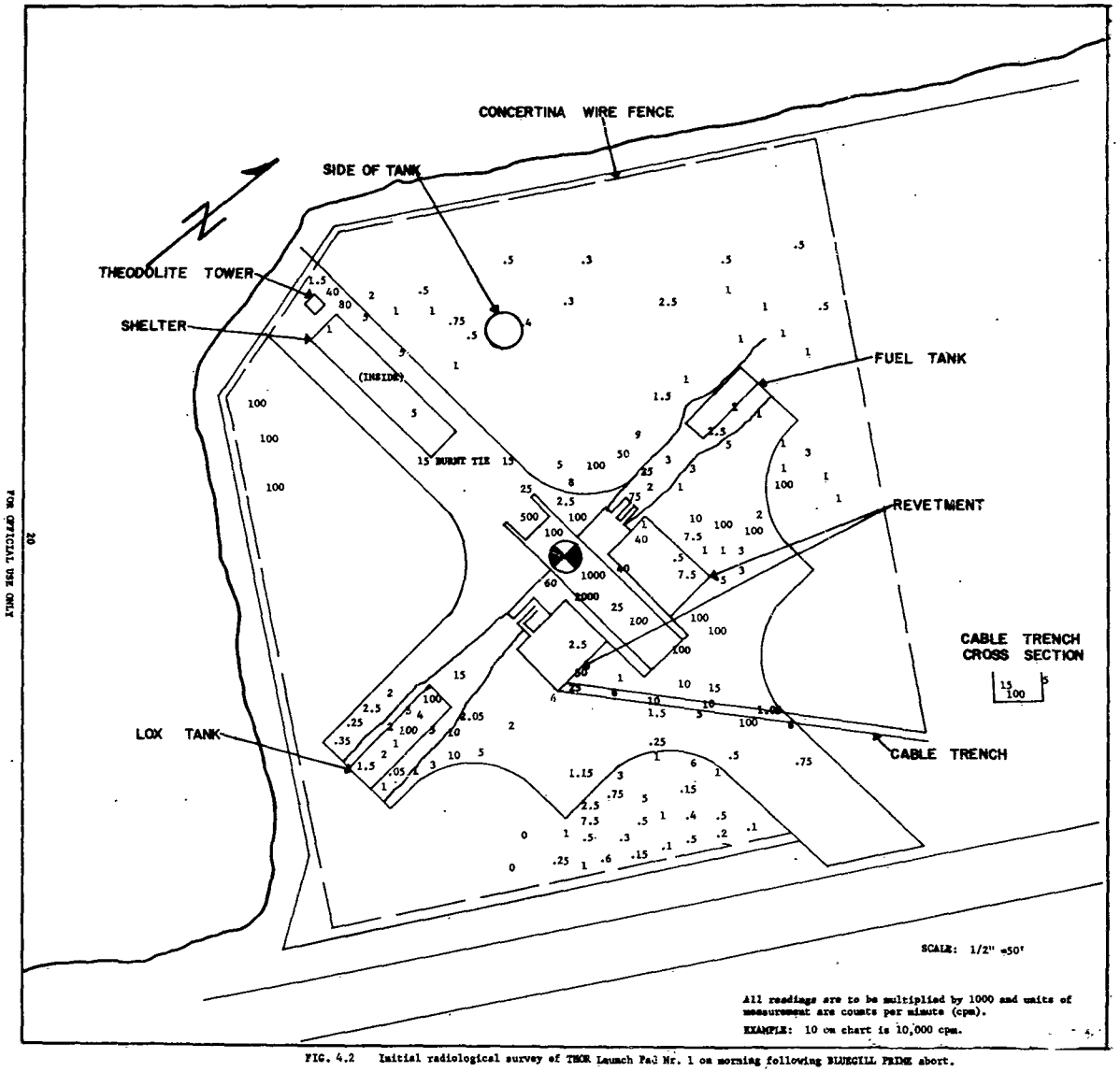

FIG. 4.2 Initial radiological survey of THOR Launch Pad Nr. 1 on morning following BLUEGILL PRIME abort.

levels of activity obtained by using Eberline PAC-3G and Eberline PAC-1S alpha survey meters. No attempt has been made to draw-in isocon lines. The irregularity of deposition can be attributed to fire-spread, fuel run-off, thermal up-drafts, and vortex winds of complex behavior. In view of the nature of this event, lack of particle distribution data, and an urgent necessity to rehabilitate the pad for subsequent shots, no effort was made in analyzing the magnitude and extent of the radiological hazard incident to the destruct of a nuclear device on a launch complex. No launch pad rehabilitation could be attempted until the radiological hazard had been brought under control by careful removal and fixing of contamination. A systematic procedure of debris removal, segregation, top soil (coral) removal, compaction, decontamination of hardstand and revetments followed by painting and fixation, and finally a sea-disposal of radioactive waste was required for control of the radiological hazard.

The following steps were taken to decontaminate and rehabilitate the pad:

1. All coral areas were sprinkled with oil to decrease the amount of contaminated airborne dust. Approximately two inches of top soil was graded off the coral surface. This contaminated soil was bulldozed over the embankment into the water at the northwest corner of the pad area.

2. The concrete pads were scrubbed with detergents and solvents to remove all loose contamination. The pad under the launch mount was then coated with epoxy paint. The remainder of the concreted areas, including the fuel tank and lox tank pads were covered with either epoxy or latex paint to fix the remaining contamination.

3. The revetments were washed, scrubbed, and painted.

4. The bottoms of all cable trenches were coated with one inch of concrete and the sides of the trenches were painted after scrubdown and washing. Contaminated cable trench covers were disposed of and replaced with new covers. Cable conduit pipes leading from the cable trench sumps inside the revetments were sealed at each end with either concrete or steel plate.

5. The missile shelter was scrubbed or scraped to bare metal and repainted. The wooden ties supporting the shelter rails were covered with concrete.

6. All electrical ground connection wells were filled with concrete.

7. All expansion joint grouting on the concrete pad was removed and replaced.

8. All equipment, tools, etc., that could not be decontaminated were disposed of in accordance with AEC standards by burial at sea.

9. The long range theodolite tower and the camera tower were scrubbed and repainted.

A radiological exclusion perimeter and a personnel decontamination station were the means of enforcing safety measures and avoidance of spreading of the contamination. The decon facility consisted of a "hot" tent with laundry, two showering compartments, a "clean" tent for clothing issue, and monitoring personnel including an enlisted medical corpsman. Air sampling at locations in main camp, adjacent to the decon tent, and within the launch pad enclosure was performed to assess the progressive decline of air-borne hazard arising from artificial resuspension. Task Unit 8.5.1 supplied the labor force and radsafe supervisory personnel during the reconstruction phase. These personnel were required to wear full protective clothing while working in the "hot" area. Six enlisted radsafe personnel, and a USPHS Officer, assisted the JTF 8 Radsafe Officer in supervision of this force. A period of approximately three weeks was required to reduce the alpha contamination to the point where it did not constitute a health hazard.

The following represented the condition of the launch pad area as of the time of termination of the test series:

1. All contaminated areas and surfaces were covered with protective coatings of either paint, concrete or clean coral sand.

2. All contamination was fixed. There was no evidence that the alpha contaminant was being moved by either vehicle or personnel.

3. Daily air samples showed that no contaminant was being resuspended.

The following were the procedures used in maintaining continuous surveillance.

1. Daily inspections were made of the entire launch pad area by radsafe personnel.

2. All painted surfaces which showed any deterioration for any reason, such as missile firings or construction work, were checked for loose contaminant and then repainted. Paint chips were placed in barrels for disposal at sea.

3. Any removal of the clean coral sand and exposure of the contaminated coral, either as a result of missile firings, heavy rains. or construction, was immediately remedied by replacing with clean coral sand. Any loose coral sand that was contaminated was immediately disposed of by dumping into the lagoon.

4. All chipped or broken concrete was either replaced with fresh concrete or exposed surfaces were painted if contaminated. The concrete fragments were placed in barrels for later disposal at sea.

5. All personnel working in areas where contaminated coral was exposed were required to wear canvas or rubber booties until such time as the contaminated areas were resurfaced with clean coral sand. Painters

chipping paint or repainting contaminated surfaces were required to wear full radsafe gear, including respirators or face masks.

6. No other radsafe restrictions were required. Shoes of individuals leaving the launch pad area were periodically spot-checked.

7. After each missile firing radsafe personnel, accompanied by the launch pad post-firing safety crew, inspected the area to determine the extent of the contamination problem and initiate any radsafe rehabilitation.

8. All tools and equipment utilized for any decontamination or rehabilitation were monitored and decontaminated if necessary.

9. Periodic surveillance was made of the kitchen and dining rooms for any contamination.

In lieu of any major decontamination effort, the procedures outlined above, implemented by experienced radsafe personnel, provided necessary radsafe protection for personnel on Johnston Island.

4.3 Johnston Island Phase II

In October 1962 a second series of air drops and a continuation of high altitude events was resumed.

4.3.1 Atmospheric Events

The air drops of devices detonated in the atmosphere again required B-57 sampler aircraft. A decon facility for aircraft and personnel was constructed at Barbers Point, Oahu, Hawaii. After completion of the cloud sampling mission the B-57s landed at Johnston Island, where trained crews from JTG 8.4 removed the samples for sealed container transport to laboratories in CONUS. Since cockpit dose rates in all four events were under 1 r/hr at H plus 4 hours, (radioactive decay varying inversely as the 1.4 power of time during the first several hours), an overnight "cooling" brought the dose rate down to a level permitting aircraft to be flown to Barbers Point without necessity for major decontamination at Johnston Island. A capability for primitive decon was provided at Johnston Island as a contingency for hasty removal of aircraft. A portion of the taxiway was isolated by a concertina wire barrier and a complete coral berm built to divert waste water flow into the run-off ditch. Fresh water was pumped through a hose from a reservoir tank for wash down. However, this field expedient was never used since the only radiological decon was that prompted by nuisance puddles of water resulting from short duration rain showers. Radiation levels from these were never more than 20-40 mr/hr close to the surface. The personnel decon facility erected after BLUEGILL PRIME event was utilized for sampler aircraft crews as well as a routine radsafe support installation.

4.3.2 High Altitude Events

The BLUEGILL DOUBLE PRIME missile was destroyed in flight and a very small amount of radioactive debris, consisting mostly of light weight fragments of components, fell onto Johnston Island. No injuries or contamination resulted.

BLUEGILL TRIPLE PRIME event required radsafe support for instrument recovery and handling. Contamination was of low intensity, permitting immediate removal of detector elements for early analysis.

4.4 Shots and Survey Results

Table 4.1 contains a list of the nuclear events which occurred near Johnston Island. Technical details pertaining to these may be found in the reference cited in Chapter 2, Section 2.3.

With the exception of the STARFISH and BLUEGILL PRIME events, no hazardous contamination occurred. All other events involved only recovery, monitoring, and handling of the scientific pods which were recovered and disassembled without mishap or injury. No personnel radiation exposures of any significance were observed.

Table 4.1

JOHNSTON ISLAND EVENTS DURING OPERATION DOMINIC

NAME OF EVENT	DATE	* YIELD RANGE	TYPE
BLUEGILL	3 Jun 62	Abort	Thor
STARFISH	19 Jun 62	Abort	Thor
STARFISH PRIME	8 Jul 62	Low Megaton	Thor
BLUEGILL PRIME	25 Jul 62	Abort	Thor
ANDROSCOGGIN	2 Oct 62	Low	Air Drop
BUMPING	6 Oct 62	Low	Air Drop
BLUEGILL DOUBLE PRIME	15 Oct 62	Abort	Thor
CHAMA	18 Oct 62	Low Megaton	Air Drop
CHECKMATE	19 Oct 62	Low	Sergeant
BLUEGILL TRIPLE PRIME	25 Oct 62	Intermediate	Thor
CALAMITY	27 Oct 62	Intermediate	Air Drop
JOUSATONIC	30 Oct 62	Megaton	Air Drop
KINGFISH	1 Nov 62	Intermediate	Thor
TIGHTROPE	3 Nov 62	Low	Nike-Hercules

* Low yield is below 100 KT

Intermediate yield is 100-1000 KT

Low Megaton yield is 1-5 MT

Megaton yield is above 5 MT

Chapter 5

PERSONNEL DOSIMETRY

5.1 Film Badge Processing and Record Posting

Two dosimetry sections were required for the Pacific Test Area. One was established at Christmas Island and the other in Honolulu, Hawaii. The Christmas Island section handled all film badge dosimetry for the Christmas Island operation, using the Honolulu, Hawaii installation as a back-up. The Honolulu installation performed all dosimetry for the Johnston Island site personnel and the Barbers Point site personnel.

Approximately 43,000 film badges were issued during the period 1 April-1 November 1962. During this same period approximately 33,000 film badges were processed using standard techniques. Density shown on film was then read using the Eberline densitometer and converted into dosage using a standard calibration dosage curve. The calibration curve was established under the normal process of exposing unused film against a known radiation source for specified periods of time.

The dose record cards (5x8 data card) were prepared in the Honolulu section, utilizing four to six female clerks hired locally. Approximately 20,000 5x8 data cards were typed and initial dosages posted.

Film badges worn by sampler aircraft crews were collected immediately after each event and returned to Radsafe Branch Dosimetry Section for expeditious processing (6 hours) of dosage information to successive sampler crews. A photodosimetry trailer on loan from the USAF, operated by JTF 8 radsafe personnel, was located in the JOC area. This trailer contained the necessary equipment for developing and drying film. Subsequently, film was read in the FS-3 densitometer manufactured by the Eberline Instrument Corporation. Two such instruments with auxilliary punch card readout, together with an addressograph machine, were situated in the building next to the trailer. This completely air conditioned building housed the dosimetry section and the TU 8.5.1 radsafe office on one end, the JTG 8.4 instrument repair section on the other end, and provided utilities service to the photodosimetry trailer.

The dosimetry operation at Christmas Island was closed and relocated in Honolulu, Hawaii near the end of the Christmas Island test series.

On 1 November 1962 the Honolulu dosimetry operations were terminated and preparations were initiated to transfer all processed film, film requiring processing, and records and materials to the Nevada Test Site (NTS), Mercury, Nevada. Reynolds Electrical and Engineering Company (REECo), located at NTS, had agreed to do the final portion of film badge processing and prepare a final IBM listing with the assistance of seven selected JTF 8 radsafe personnel. Four of the original JTF 8 personnel arrived 7 November 1962 and the remaining three arrived during the period 17-20 November 1962. The equipment and associated materials began to arrive at NTS between 14-17 November 1962.

Approximately 10,000 film badge packets were opened by JTF 8 radsafe personnel and sent to the REECo dosimetry laboratory for processing. Approximately 1,000 additional 5x8 data cards, NAVMED forms (naval medical forms indicating U.S. Navy issue), and approximately 30,000 listings were posted, finalized and coded for IBM key punching during the period 17 November - 11 January 1963. A few film badges were still being received at the time of publication of this report.

In order to utilize the IBM system for listing final rosters, organization codes were established by groups in the quantities indicated below:

GROUP	NR. OF SEPARATE CODES
HQ JTF 8	10
U.S. Army	92
U.S. Navy	162
U.S. Air Force	400
Civilian	85
Total:	749

Interim listings were furnished by the IBM division of REECo, and after the final review, all dose cards were sorted and the final listings were prepared in the quantities as follows:

TYPE	NR. OF LISTINGS
Alphabetical	12
Alphabetical-Organization	12
Service-Alphabetical	4
Service-Organization	4
Numerical-Non Returned Badges	4
Alphabetical-Non Returned Badges	4
Unassigned Badges	4

All copies of the final report were delivered to Hq JTF 8, Washington, D.C. by the NCOIC, JTF 8 Radsafe Branch. The reports were then separated and sent to the proper cognizant agency; Surgeons General, USA & USAF; Chief, Bureau of Medicine and Surgery, Navy Dept.; Chief Medical Officer, USCG; and the Division of Operational Safety, USAEC.

Four JTF 8 radsafe personnel remained at NTS for the final roll-up, which included assembling all final data records and processed film into acceptable order for proper storage at NTS by REECo. Upon completion of all dosimetry work for Operation DOMINIC, with the exception of unreceived film badges, the JTF 8 Radsafe Branch Dosimetry Section was dissolved and all personnel returned to their home stations.

5.2 Film Badges

The film badge program was designed to provide a dosage-indicating device to all personnel in the Task Force in order that complete dosage information could be maintained on everyone entering the Christmas and Johnston Islands area during the operation. Film badges were issued to all individuals upon their arrival at these locations, with instructions that the badge would be worn at all times, and would be turned in on recall by Radsafe Branch, upon exit from any contaminated area, return from a cloud sampling mission, or upon departure from the test area. The badge consisted of the DuPont 556 film packet (508 component 0-10r range and 834 component 0-1000r range) dipped in ceresin wax and then packaged in a rigid polyvinyl chloride (PVC) case. The purpose of the wax dip and the PVC case was to make the film packet impervious to moisture in order that it might be worn for several months without deterioration. Based upon extensive experience, and a check of overall efficiency of the packaging of similar badges used during Operation HARDTACK (JTF 7), it was not expected that any significant failure in packaging would be observed. However, near the end of the operation when certain film lots were being processed, it was observed that higher-than-expected dosage readings were being obtained. An immediate check of the rosters revealed that the individuals who had worn the badges could hardly have received such dosages, since thay had not participated in any operation which would have subjected them to such an exposure. A subsequent analysis of the film indicated that the film pack suffered deterioration due to environmental conditions. This deterioration was sufficient to cause an erroneous reading of the film. Careful examination of the film base fog revealed the pattern observed to be that of the characteristic associated with environmental damage such as heat, light, and humidity, and not that of ionizing radiation. The wax dip was suspected of being inadequate, rendering the film packet vulnerable to seal failure with resultant light damage.

During the operation 43,000 badges were issued, processed, and the information recorded. Records were maintained on approximately 30,000 individuals.

5.3 Pocket Dosimeters

Pocket dosimeters, Bendix Model No. 611, 0-5r range, were also used as a means of obtaining quick information on aircraft crew dosage.

Chapter 6

SUPPLY

6.1 Procurement of Equipment

RADIAC instrumentation and radsafe equipment was obtained primarily from the Nevada Test Site (NTS) or procured by Task Unit 8.5.1 (H&N). Table 6.1 contains the main items acquired for use in the forward area.

6.2 Instrument Maintenance

The mission of the Instrument Maintenance Section was that of maintaining and calibrating all portable RADIAC instruments for JTF 8 Radsafe. The section consisted of one officer and four enlisted men, assigned to duty to JTG 8.4 and located on Christmas Island.

By mid-April all instruments had been calibrated and issued to the various groups on Christmas Island and off-site stations. The instruments on neighboring islands were kept operable by constantly exchanging them for newly repaired instruments. During the remainder of April, approximately 200 instruments were calibrated and 80 were repaired. During the month of May, approximately 250 instruments were calibrated and 100 repaired. This was due to the almost continuous use of many of the instruments. During the month of June, approximately 50 instruments were calibrated and 20 repaired.

During Operation DOMINIC, approximately 98 percent of all the instruments were in working order at all times. Of these, about 5 percent were held in the instrument repair ship as a contingency replacement of any instrument in need of repair at a crucial time. Any delays in the repair of the instruments were due to shortage of spare parts. Resupply of parts required 60 days procurement lead time.

Eberline Instrument Corporation provided electronic engineers at all times to perform maintenance on the Eberline instruments, including the film densitometer. The remainder of the instruments, of other manufacture, were maintained by the U.S. Army personnel assigned to the instrument repair shop.

Table 6.1

RADSAFE EQUIPMENT AND SUPPLIES

QUANTITY	ITEM	SOURCE
20	E500B Eberline Beta-Gamma Geiger Counter	H&N (TU 8.5 1)
4	GADORA-2 Eberline Gamma Dose Rate Meter	H&N
15	E112B Eberline Beta-Gamma Geiger Counter	H&N
17	PAC-3G(AN/PDR-54) Eberline Alpha Contamination Meter	H&N 7 - NTS 10
15	MX5 Beta-Gamma Geiger Counter	NTS
12	IM-108 Gamma Survey Meter	25th Inf. Div., Ft Shafter
100	AN/PDR-39 Gamma Survey Meter	NTS
4	AN/PDR-39(T1B) Gamma Survey Meter(Mod. for high range)	NTS
100	AN/PDR-27J Beta-Gamma Survey Meter	Sacramento Sig.Depot,Calif.
2	FM-3G Eberline Alpha Floor Monitor	H&N
4500	4.025 Density Goggles	H&N
2000	4.5 Density Goggles	H&N
400	Pocket Dosimeters, Bendix Model No. 611 (0-5r)	H&N
3	FD-2 Eberline Film Densitometer	H&N
2	FS-11 Eberline Film Badge Evaluation & Recording System	NTS
2	Cobalt 60 Calibration Source	H&N
1000	Charg-a-Plate	H&N
1200	Coveralls	H&N
1000 pr	Canvas Booties	H&N
1000	Poly Bags	H&N
500 rls	Masking Tape	H&N
50	Respirators	H&N
50	Full-Face Masks	H&N
10	M-9 CmlC Protective Mask	H&N
1000 pr	Gloves, Tariff Issue	H&N
50	Surgeon's Cap	H&N
50	Hoods	H&N
2	T-289 Tritium Monitor	DASA FLD CMD
2	T-329A Radiological Urinalysis Kit	DASA FLD CMD
2	T-336 Alarm	DASA FLD CMD
1	Wound Monitor	H&N
25	RM-5 Eberline Radiation Monitors complete w/R-1 Chart Recorder	H&N
2	PC-6 Eberline Scaler complete w/SAC-2 & PC4-4 Detector Heads	H&N
2	E-113 Electronic Tool Sets	H&N
1	526 Summary Punch	H&N
4	Sellers Injector Corp. Liquid Jet Cleaners complete w/Lance & Discharge Hose	Procured by JTF 8, J-4
40	Staplex Hi-Vol Air Samplers	H&N
2	Gelman Air Sampler w/Dry Test Meter	USPHS
1	Band Saw (For opening plastic film badge packet)	H&N